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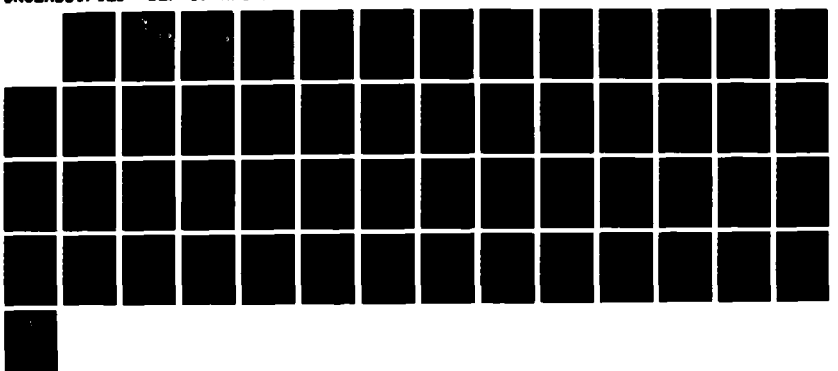

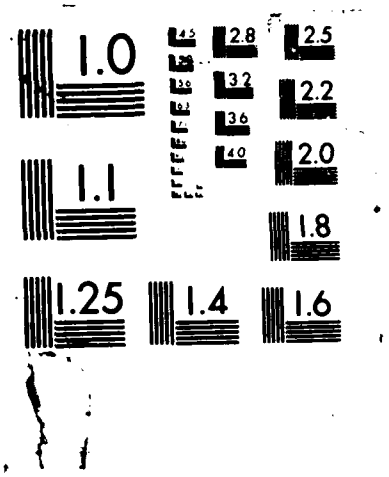
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INFORMATION NEEDS ANALYSIS FOR THE AERONAUTICAL SYSTEMS DIVISION EXECUTIVE INFORMATION SYSTEM

THESIS

Kenneth J. Lentini
First Lieutenant, USAF

AFIT/GLM/LSMA/87S-42

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY
Wright-Patterson Air Force Base, Ohio

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INFORMATION NEEDS ANALYSIS FOR THE AERONAUTICAL SYSTEMS DIVISION EXECUTIVE INFORMATION SYSTEM

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Kenneth J. Lentini, B.B.A.
First Lieutenant, USAF

September 1987

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Preface

The purpose of this study was to determine, using Ostrofsky's design and planning methodology, the adequacy of the information provided to the executive managers at the Aeronautical Systems Division (ASD). To accomplish this objective, a sample of executive managers from ASD were interviewed to determine their information needs versus the information which was available to them. The results of this thesis are not intended to solve the information requirement problems of the line executives, but rather are meant to be the first step in a series of research efforts leading to a solution to these problems.

In researching and writing this thesis, I received a great deal of help and support from others. My sincerest appreciation goes to my thesis advisor, Lt Col R. E. Peschke, for his expert assistance and his personal encouragement. I also wish to thank Dr. D. E. Reynolds for his timely help and ceaseless enthusiasm. A word of thanks must also go to Capt C. Davis for taking the mystery out of writing a thesis. I wish to thank my wife, Christina for her endless support, and understanding. Finally, I thank God for blessing me throughout this effort.

Kenneth J. Lentini

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Abstract

The purpose of this study was to determine, using Ostrofsky's design and planning methodology, the adequacy of the information provided to the executive managers at ASD. To accomplish this objective, a sample of executive managers from ASD was interviewed to determine information needs versus the information which was available.

The results indicate that staff executives are receiving the information they need in the form which they prefer, while the line executives lack the automated data which they need. Research also revealed that most ASD executives are not satisfied with the Automated Management System for many reasons such as lack of current data.

The objective of this thesis was not to solve the information requirement problems of the ASD executives. Rather it was intended to be the first step in a series of research efforts leading to a solution to these problems.

Keywords: information exchange; information processing; information transfer; management information systems

INFORMATION NEEDS ANALYSIS FOR THE AERONAUTICAL SYSTEMS DIVISION EXECUTIVE INFORMATION SYSTEM

I. Introduction

Overview

This chapter provides background on information systems, the general issue, the statement of the problem, the purpose of the study, the investigative questions, and the scope and limitations of this research.

Background

The rapidly increasing use of computers and computer technology has provided Air Force managers with ever-increasing volumes of data. "Data, the raw material for information, is defined as groups of nonrandom symbols which represent quantities, actions, things, etc." (6:32-33). Inherent in the manager's job, then, is the act of converting data into information which can be meaningful for decision making. "Information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or prospective decisions" (6:32). This definition can be illustrated using the following equation:

Information = Facts, Figures + their meaningful connections (17:3)

By definition, then, information is only valuable if it aids the manager in decision making. If no decisions or choices must be made, the information becomes unnecessary (6:32).

A "System" can be defined as a combination of people, hardware, procedures, and the relationships that exist between these resources for the accomplishment of unified goals or objectives. A Management Information System (MIS), then, can be considered a combination of people, equipment, facilities, procedures, and other resources that are organized for the purpose of creating, collecting, protecting, analyzing, storing, retrieving, and disposing of information (17:3).

The relation of data to information, then, is one of raw material to finished product. An MIS transforms data from an unusable form into usable data which becomes information for the user. This analogy shows that information (finished product) for one person may be data (raw material) for another - just as the finished product for a machine shop may be the raw material for an assembly shop (6:32).

Many Air Force organizations appear to be wasting time and energy processing data into information. For example, the Aeronautical Systems Division (ASD), Wright-Patterson Air Force Base, and systems program offices (SPOs) throughout the Air Force are responsible for tracking the status of thousands of contracts, equipment items, and contract modifications. A tremendous amount of information processing

resources are available, yet the managers in these organizations often struggle to obtain the information they need to efficiently accomplish these tasks. Their MISs have historically been developed by each office rather than from the top-down (1:3; 8).

Aeronautical Systems Division has recognized this problem and in 1981 developed the Automated Management System (AMS). The AMS concept is to ..."provide a consistent, common, simple, and reliable interface between the users and the AMS Network" (5:5). AMS, then, was created to incorporate the top-down approach to developing an MIS. For reasons yet to be determined, managers at ASD have not had their information resource needs fulfilled by the AMS (8).

Many reasons may exist to suggest why the managers at ASD perceive they have inadequate information resources. The resources may in fact be inadequate, or they may just be inefficiently or improperly utilized. Before a research effort can attempt to resolve such a management problem, an analysis of information requirements must be performed. "[Such a] needs analysis provides the justification for proceeding further with the expenditure of time, effort, and other resources" (16:31). For research to be successful, then, the needs must be clearly and adequately defined, and they must be important enough to warrant the expenditure of significant effort in their definition (16:32). Ostrofsky further clarified the crucial nature of needs analysis as follows:

> A deficiency in the determination of needs or an improper determination of emphasis on certain aspects of a problem can cause the entire sequence of decisions which will be made to emerge with a solution to a problem other than the one requiring resolution [16:31].

Statement of Problem

The present MIS(s) within ASD are not adequately providing the necessary information to management. The need exists to determine what information resources are actually available to and what are needed by the executive managers of ASD.

Purpose of Study

Following Ostrofsky's methodology, this research has identified executive information requirements for ASD and will serve as the needs analysis. The needs analysis is the first step in the feasibility study and is intended to be used as a guide for a series of future programmatic research efforts. The flow diagram in Figure 1 illustrates the steps required to complete the feasibility study (16:29). During the feasibility study, the researcher develops a set of solutions to meet the stated needs. The primitive needs referred to in the diagram were identified in the problem statement. The actions following the feasibility study will accomplish the development of necessary hardware and software applications to culminate in the design of an MIS which would optimize the information flow between management levels at ASD.

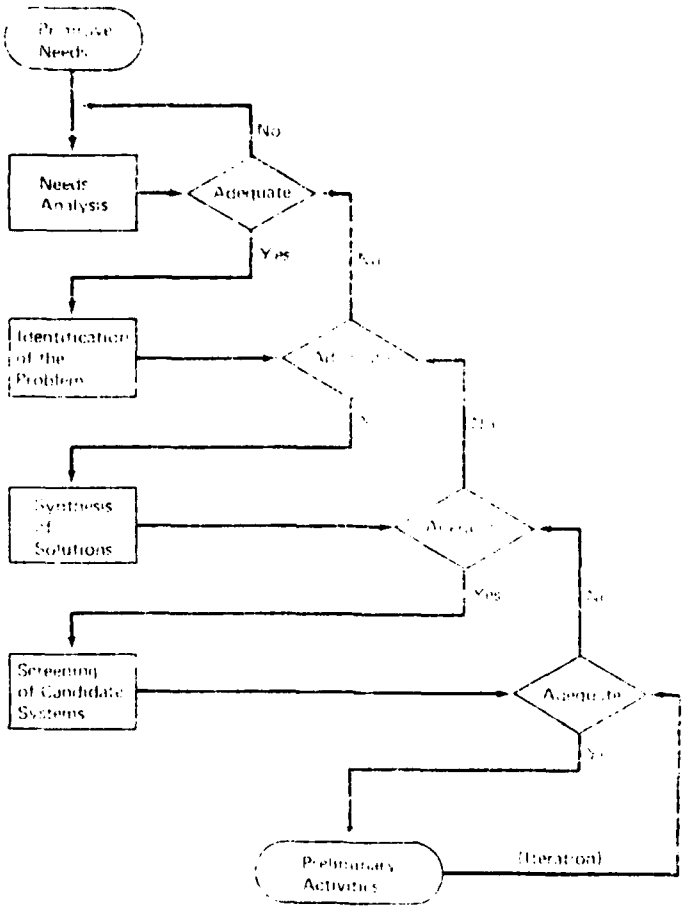

Fig.1 Feasibility Analysis

Investigative Questions

To accomplish the research objective, data were collected to answer the following investigative questions:

1. What information is required by the ASD Command Section?

2. What information is required by the Deputy Commanders at ASD?

3. What information is required by the program managers at ASD?

4. What information, if any, does ASD's current executive MIS fail to provide to the executive level?

5. What extraneous information, if any, does ASDs current executive MIS provide to the executive level?

Scope of Study

This study did not attempt to design the hardware or software necessary to optimize the information flow to executive managers at ASD. This study does, however, provide a comparison analysis of the data processing requirements of these managers versus what they are provided by their current MIS(s).

Limitations of Study

The sampling technique used in this research, explained in Chapter III, is subjective in nature and may therefore be difficult to replicate. The survey technique employed also had some disadvantages. Response errors were possible because some respondents may have had difficulty responding accurately on topics in which they were less than expert perhaps due to ego (3:301). Also, the interviewer could have introduced bias, although every effort was made to assure that this did not happen. For these reasons, any generalizations of the results of this research to other organizations should be approached with caution.

II. Requirements Determination Concepts

Overview

Almost all organizations have experienced a rapidly increasing demand for information. The degree and extent of usage of computer based information systems varies widely from industry to industry and from organization to organization. The use of such systems has also increased in sophistication and complexity. The key to the success of any information system, however, is a detailed analysis of the user's needs.

Role of Information

George Mushalko determined that three activities consume the majority of a manager's time. These are reviewing formal documentation, reviewing formal correspondence, and attending meetings/briefings. Executive officers spend much less time in meetings than managers, but they spend more time reviewing, routing, assigning, and tracking correspondence. In fact, Mushalko says that nearly 75 percent of an executive's time is spent directing, coordinating, and following-up on correspondence of some sort (15).

Mushalko also found that the average time available for planning/developing strategies was only 9 percent, and this was the most frequently indicated area of frustration. Mushalko's respondents felt that an improved editing process at all levels, starting with the action officer, would

expedite the review process and thereby create more time for planning. This process would include an improved review for grammar and word choice. They also identified their most important information requirements as being budgetary, for example, program objective memorandum inputs. Of particular importance was information such as the current status, the activity schedule, and a summary of the current major issues. Virtually all of those interviewed desired their information in tabular form with half also indicating a need for graphic representations. One third also desired a textual briefing format (15).

Porter and Millar argue that information technology is assuming strategic significance in that it is changing the process by which companies develop products. It increases the power of buyers in component assembling industries because buyers can easily evaluate sources of materials and make/buy decisions. Barriers to entry have risen in those industries requiring large investments in complex hardware and software. Information technology is spawning new products and businesses, for example: electronic mail services. Companies are also making use of their ability to process information as a by-product to sell to other companies. For example, Sears sells its skills in processing credit card accounts to companies such as Phillips Petroleum and Mellon Bank. The authors provide five steps for senior executives to follow to take advantage of the opportunities which the information revolution has created:

1. Assess information intensity of the products and processes in its business units.

2. Determine the role of information technology in industry structure.

3. Identify and rank the ways in which information technology might create competitive advantage.

4. Investigate how information technology might spawn new businesses.

5. Develop a plan for taking advantage of information technology. (18:158-159)

Complexity

In "Target Information for Competitive Performance," Robert E. Cole shows that the way companies use information shapes organizational policy and that a complex, computerized system is not always the most effective means for improving performance. He compared Japanese and American manufacturing companies and showed that the Japanese use more selective and generally simpler information systems. For instance, they focus less on measuring the costs of quality than on the information needed to upgrade quality (4).

One example of a simple information system, according to Cole, is the just-in-time delivery system, or kanban. "The term kanban refers literally to a block of wood that tells the supplier, or the person who represents the immediate upstream process, to refill a particular order" (6:103). Due to the daily fluctuations in automobile production, the Japanese feel that no computer program can control production as well as kanban does (4).

Cole states that American manufacturers commonly use elaborate and expensive inventory control systems that depend on complicated computer programs. Simpler information systems allow for immediate feedback from the workers closest to the problem and thereby permit timely corrective action. American manufacturers further increase their information processing needs by establishing an excessive organizational hierarchy. American auto plant managers were found to be six or seven layers removed from the chief executive while Japanese plant managers are never more than two layers away and also serve on company boards of directors (4).

In "Use and Organizational Implications of Database Systems: Some Hong Kong Experiences," Mr. Ho focused on the technical and organizational problems associated with the use of computerized database systems. Data for the article were derived through postal questionnaires and personal interviews. "Analysis of the returned questionnaires showed that almost 64% of the responding firms are currently using, or planning to install a database in the future" (9:27). The survey analysis also revealed that most organizations using DBMSs must upgrade to a new DBMS periodically and that these systems have been used mostly in larger companies. The Banking/Finance and Manufacturing industries show the highest rates of utilization within Hong Kong. Of those organizations that did not consider a database installation, most cited fear of the unknown and lack of knowledge as

their reasons. Mr. Ho believes their real reason is that they do not appreciate the value of information as a corporate resource. They view DBMSs simply as a file management method. Connected with this is the position of the Data Base Administrator (DBA), "...the key person who is in charge of database functions and has responsibility for the overall planning, design, and control of the technical structure as well as the content of the database" (9:30).

Mr. Ho's survey data indicate that the relative position/status given the DBA reflects the degree that corporate management supports DBMS as a corporate resource and ultimately affects the success of the system. The conversion of standard programs and files to a new database system is a huge problem complicated by the fact that the end user has historically not been consulted with. The survey shows that only 38% of DBMS projects were planned with the involvement of end users. "Statistical analysis shows that users who are involved in the database project feel more satisfied with system quality" (9:31). Lack of user involvement is also seen in those organizations in which the DBA is given relatively low status. The analysis indicates that most users are satisfied though not thrilled with their DBMSs. They feel that their DBMS provides them better information for decision making, but are unsure of there being any cost saving (9).

User Involvement

In 'Organizational Learning and Management Information Systems,' Mr. Argyris cited several areas where the implementation of management information systems (MISs) left the users disappointed:

1. MIS were not well understood by line management.
2. Top line management was not involved in persuading and selling the use of MIS to the users in the organization.
3. MIS were not as foolproof as they could be.
4. MIS were technically too complex to create and utilize.
5. MIS specialists and line managers did not understand each other's job requirements, perspectives and pressures.
6. MIS ignored line managers' cognitive styles.
7. The implementation of MIS was too narrowly conceived.
8. MIS were not humanized adequately. (1:3)

He believes that these problems are a part of a more general problem of organizational learning, that is the ability of an organization to detect and correct errors. Organizations learn through individuals whose organizational environment encourages learning activities. Argyris feels that most organizations are better at discouraging than encouraging learning. He also points out that different levels of management require different levels of completeness in their information. Top level managers must work with large information gaps while first level managers require much more complete information. To be effective,

then, each level must have an MIS with somewhat different properties (1).

In "E Pluribus Computum", J. Daniel Cougar asks the question, "Computers for all - but at what price?" He discusses the effectiveness of end-user computing in organizations against the cost of such systems. End-user computing is a concept which enables users to develop their own applications using micro-computers (5).

Cougar found that 11 of the 17 companies he studied had problems with their end-user computing systems. For example, several of the companies had bought micro-computers and software packages from as many as eight different companies only to find that the various systems were not compatible with each other. Many companies often purchased the most expensive DBMS available rather than assessing their actual needs. Many companies instituted hard controls to combat spiralling MIS costs. These proved ineffective as users found ways to circumvent the controls (5).

Cougar also found that the managers in the successful companies planned their end-user policies which avoided most of the problems cited above. They provided company policy to standardize the purchase and subsequent use of hardware and software. Purchases were centralized to take advantage of volume discounts. Lastly, the successful companies were able to provide cost-effective instruction on the use of the standardized hardware and software (5).

Lucas and Neilsen investigated the impact of the mode of information presentation on decision making. The mode they refer to is the form of output to which the user is exposed. Their experiment used a type of game in which various logistics scenarios were faced by the players. For example, each firm might have a single production facility, multiple warehouses, and a variety of transportation methods at their disposal. Holding selling price constant, they had to make decisions which would increase sales while lowering the total cost of logistics (11).

The experiment was performed using three groups: graduate students in the MBA program at Stanford University, practicing engineers from the summer Industrial Engineering program at Stanford University, and senior executives attending an eight week continuing education program at Stanford (11).

The results indicated that graduate students achieved a high rate of profit increase very quickly while the other two groups required more time to become efficient. Lucas and Neilsen attributed this to the student's experience in case work and game-playing from school. All groups, however, showed significant period-toperiod profit improvement. This improvement could not be statistically linked with the use of increased amounts of information or with the use of enhanced graphics. Instead, the results stressed the importance of considering individual and group differences when designing an information system (11).

Mansour and Watson have shown that while computer hardware and software are important factors contributing to the successful use of an information system, behavioral, structural, and environmental variables also are important. Examples of these variables are: the degree of top management involvement in the development of the system, the amount of resistance to change exhibited by the personnel in the organization, the amount of training provided to the users, and customer requirements. The results of this study stress continual monitoring of these types of variables in order to achieve high overall organizational performance (12:521-532).

LaRue and Leahy described an optimum information system as one that provides the user precisely the required information at the desired level of management interest, at the right place, at the right time, and at the right price. They suggest that if a user chooses not to use the information provided by the system, for whatever reason, the system becomes merely an historical file that is extremely wasteful of resources and energy (10). Larue and Leahy also sight several obstacles to the effective use of information systems. First is age. Top executives, on the average, are older than lower level managers and consequently may be more reluctant to accept new methods than younger managers who have grown up in a world of changing technology. Second is education. Infrequent or reluctant usage of an information system has been related to a lack of training and education

regarding the system. Third is the perception of a threat. Some managers feel that an information system will make their jobs appear less important or may actually replace them. Others feel that their subordinates, who are more familiar with the system through daily contact, will become the brains of the organization. Fourth is an unfamiliarity with the system. Managers often feel insecure due to a lack of knowledge or understanding of computers. This can lead to a minority of people within an organization producing a majority of the required information. Last are numerous system design problems. For example, MIS projects are often started without the establishment of clear objectives and goals which result in the design of a system which does not meet the needs of the users. System development responsibilities, perhaps due to senior executive reluctance to use computer systems, are often delegated to lower level managers. This often results in a system which fails to integrate all of the organizations requirements for information. Compounding this problem is the fact that, historically, managers have had difficulty expressing their information needs. This can result in reduced system flexibility and/or an attempt to provide all conceivable information (10).

Importance of Needs Analysis

King and Cleland suggested that the lack of management involvement in the design process (that is, in determining information requirements as well as other activities) has

been a significant factor contributing to the failure of many MISs to perform as well as expected (3:286). Ostrofsky wrote of the importance of understanding the consumption (or operation) activities in the definition of needs since these activities normally represent the ultimate application of the results. He explained that the product of a needs analysis should be a general statement of goals which the future system must satisfy. This analysis is illustrated in the following figure:

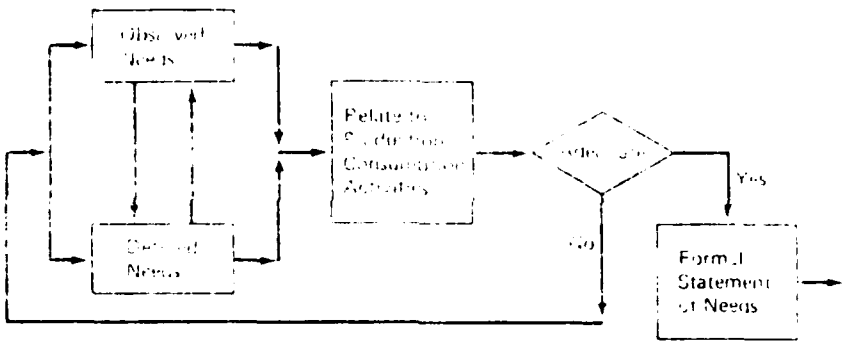

Fig. 2 Needs Analysis (16:31)

Without these goals as a guide, an organization is likely to rush into the development of a project which does not contribute to the overall corporate goals. Therefore, the identified needs must be explicitly defined, and important enough to warrant a great amount of effort to be expended (16:31-33).

Broome confirmed this in his study of the office of the U.S. Army Military Personnel Center's Deputy Chief of Staff for Operations and Plans (DCSOPS). He found that they used six information systems to fulfill planning needs. These systems were designed independently of each other in the late 1960's and early 1970's. As a result, overlaps exist in the information contained in and reported by those systems, and their file structures are generally incompatible. This problem of multiple systems extends further to the interrelationships between the DCSOPS and other organizations which maintain their own MIS's. These MIS's contain data which is identical to that maintained by the DCSOPS. This has been the custom due to the various manager's mistrust of the information provided by the other organizations. Such data redundancy leads to many problems, not the least of which being duplication of effort (2).

III. Methodology

Overview

This chapter describes the steps which were taken to accomplish the research objective and answer the investigative questions posed in Chapter I. This section defines the population and the sample from which the data were collected, the techniques used to collect and process the data, the tests employed to analyze the data, and the results to be produced using this data.

Research Procedures

A literature review was performed in which the researcher focused on topics concerning information flow and information needs within organizations rather than a general review of database management. Using the information obtained through the literature review, the researcher then developed the questions which were used in personal interviews with a selected sample of the following executive managers:

1. The staff of the ASD Commander.
2. Program managers. (Investigative questions 1,2,3).

Next, information requirements identified by the executive managers during the interviews were matched against the information available through the current MIS(s). This was accomplished manually by the researcher since the information being compared was too abstract to easily automate. To

reduce bias in the interview responses, where possible, the information problems identified by each respondent were examined for support by other respondents. (Investigative questions 4 and 5).

Methodology Justification

The literature review revealed no sources of secondary data which could be analyzed. The personal interview technique of surveying was chosen to collect the required primary data for several reasons. First, the survey technique, in general, was chosen because the researcher could not have efficiently learned a subject's information requirements and shortfalls without questioning him/her. Second, the open-ended, complex nature of the problem precluded the use of both the observation, and questionnaire survey techniques. Third, telephone interviews were deemed inappropriate because the problem required more time to discuss than would have been comfortable for a telephone subject. Fourth, only through personal interviews was the researcher able to secure information in sufficient depth and detail to accomplish the research objective (7:294).

Interview Format

All interview sessions were focused and in-person. A focused interview is a type of unstructured interview where the researcher attempts to focus on the relevant experience of the respondent. Rather than conducting a type of verbal

questionnaire with each respondent, the interviewer followed an interview guide. The guide for this research was a list of topic questions which the interviewer used as a prompter during each interview. This list appears in Table 1.

Table 1 List of Interview Topic Questions

1. What is the status of your organization in utilizing information systems?

2. What purpose(s) do you wish to achieve with your information system(s)?

3. What computer applications does your office utilize?

4. How was the system(s) developed?

5. What percentage of your staff has a working knowledge of the system(s)?

6. What types of decisions do you make?

7. What information do you use to make these decisions?

8. How is that information accessed and presented to you?

9. Is there other information that would be useful to you if it was available?

10. Is there information that you receive which is not needed?

11. How do the users evaluate the system?

12. To what extent has the current system achieved your intended purposes?

Using this loosely structured guide, the interviewer was able to lead the interview in the direction in which insight and the respondent's replies indicated. This method was appropriate since the research objective was of a discovery nature (7:214-216).

Crucial to the successful gathering of information was the interviewer's ability to establish a rapport, that is, a relationship of confidence and understanding, with each respondent. The interviewer attempted to establish this relationship during each pre-interview briefing when the respondent had the background of this research and the importance of his involvement in it explained to him. Except where explicit permission was given to quote remarks, complete confidentiality was guaranteed to each respondent. To assure a comfortable atmosphere was maintained, permission was obtained from each respondent prior to recording the interviews on tape. The interviews were also recorded in writing (7:297-299).

Population

The population of interest in this research consisted of the executive managers at ASD, Wright-Patterson Air Force Base, Ohio. The population was limited to the upper levels of management at ASD due to the enormous complexity of establishing the information requirements at such a large organization. While this limitation restricts the generalization of results to other organizations, the follow-on efforts needed to complete this programmatic research process may be adaptable for use in many areas.

Sample

The sample from which data were collected for this research was taken from the population and was chosen using the judgement technique (see Table 2). This technique was chosen and was based on the following factors:

1. Personnel who were located at Wright-Patterson Air Force Base (WPAFB). Most ASD executives are stationed at WPAFB so to have sought interviews from those stationed elsewhere would have caused an unnecessary expenditure of government travel funds.

2. Personnel whose positions, as top level executives at ASD, made their responses applicable to the problem. Within this level, an approximately equal proportion of line and staff executives was chosen to reduce bias.

3. Personnel who were willing to be interviewed. The responses of unwilling subjects, forced into an interview, could have created bias in in the overall results.

Research Product

Using the information obtained from the literature review and the interviews, the information needs were formulated into statements of project goals in the conclusions of chapter 5 (16:33). These goals are intended to be used as a guide to the eventual satisfaction of these requirements through the results of future research efforts.

Table 2 List of Interviewees

Name	Title
Ronald H. Traudt Colonel, USAF	Chief of Staff, ASD
James D. Lang Colonel, USAF	Deputy for Engineering, ASD
Douglas E. Ringwall	Deputy for Acquisition Support, ASD
Richard H. Roellig Colonel, USAF	Deputy for Contracting and Manufacturing, ASD
Terence H. Berle Colonel, USAF	Deputy for Acquisition Logistics
Clark M. Walker Colonel, USAF	Vice Commander, 4950th Test Wing
Robert R. Barthelemy	Technical Director, AF Wright Aeronautical Laboratories
Frank E. Zachary Colonel, USAF	Assistant Deputy for Development Planning, ASD
Jon S. Eckert Colonel, USAF	Deputy System Program Director Deputy for B-1B
Stanley E. Boyd Colonel, USAF	Deputy System Program Director Deputy for F-16
Harry E. Schulte	Assistant Deputy for Tactical Systems
Merle G. Carr	Assistant Deputy for Programs Deputy for Strategic Systems
Frank O. Tuck	F-15 Deputy System Program Director, Deputy for Tactical Systems
Herbert L. Bevelhymer Colonel, USAF	Director, Air Launched Strategic Missiles, Deputy for Strategic Systems

Table 2 (Cont.)

Billy C. Harlan	Deputy Director, Strike SPO Deputy for Reconnaissance/ Strike and Electronic Warfare Systems
Peter S. Smith Lieutenant Colonel, USAF	Chief, ATF Engine Management Division, ATF SPO Deputy for Tactical Systems

IV. Research Findings

Overview

This chapter contains the findings of this research effort. Since the interviews were conducted in an unstructured format, these findings were not derived through the use of mathematical techniques, but rather through a subjective analysis which determined common areas of concern among the executives interviewed.

Line vs Staff

For the purpose of this research, line executives are defined as those whose organizations contribute directly to accomplishing ASD's overall objectives while staff executives are defined as those whose organizations indirectly support the accomplishment of these objectives.

The research indicates that the staff executives at ASD are better served by the information they currently receive than are the line executives. The reasons for this dichotomy are many. Generally, at the executive level, managers do not require the level of detailed information that lower level managers need (1). Moreover, the respondents indicated that staff executives require even less detailed information than do line executives. The staff executives's interviewed believe this is so because, unlike the line executive, the staff executive's responsibilities often do not include controlling and monitoring such activities as

budgeting and scheduling. In addition, the staff executives interviewed preferred to provide assistance to the line executives on an exception basis. That is, they would rather provide assistance in problem areas which are identified by the line executives than analyze the data which indicated those problems. The line executives preferred to receive complete aggregate information, regarding their organizations, on which their decisions (budgeting, scheduling, etc.) depend. The line executives also expressed an interest in linking their information systems with their respective contractor's information systems.

Information Presentation

All interviewees indicated a preference to make unstructured, non-repetitive decisions, at the executive level, based on briefings, meetings, etc.. They also preferred printed information to information which can be accessed at a computer terminal since the information they use to make decisions is normally discussed at the meetings mentioned above. Specifically, Staff Summary Sheets were considered vital by those executives who receive them since they contain various levels of information detail, as well as the opinions of key personnel, which can be reviewed as needed. These preferences reinforce Mr. Mushalko's findings in which the executive officers interviewed spent the greater part of their workdays reviewing correspondence and

attending meetings (15) (see page 7, this study for further discussion of Mr. Mushalko's study).

The subjects of this research indicated that computerized information is better suited to the process of making repetitive decisions. For example, in the area of personnel management, the interviewees expressed a need for computerized information such as: level of education, experience, current contract, etc.. This type of information currently exists at ASD command level but is not accessible to the directorates. Access is denied below the command level since the data base cuts across organizational boundaries, and the system was not designed to protect the unauthorized disclosure of information across those boundaries. Approximately 70% of all the executives interviewed expressed a desire to personally access this type of information directly from their office computer, but must currently request this information to be manually compiled and presented in printed form. The remainder, also desire this type of information to be computer accessible, but would prefer to receive this information from subordinates in printed form.

The reason that the respondents felt that MISs were not appropriate for making unstructured decisions may have its basis in how they perceive information conceptually. Although approximately 95% of the interviewees considered information management to be a corporate resource, their actions suggest otherwise. As Mr. Ho discovered, for

example, the relative position/status of the Data Base Administrator (DBA) reflects the degree that corporate management supports the concept of information as a corporate resource and ultimately affects the success of the system (9) (see page 10, this study for further discussion of Mr. Ho's study). Approximately 75% of the deputy commanders were unaware of who was the DBA, or simply who was in charge of system planning, design, and control. This suggests that the DBA is not in a position of relatively high rank.

Information Systems and Technology Center (SI)

During the background briefing of each interview, the researcher explained that the problem statement for this research was developed from a discussion with several managers at ASD/SI. As a result of providing this information, the researcher encountered some initial resistance from approximately 40% of the interviewees. They perceived that SI was attempting to force a new system into their organizations. This opinion appeared to have been fostered by the subjects' previous experience with SI on other projects such as AMS, and suggests that the behavioral and environmental factors of information system development, as discussed by Mansour and Watson, were not considered (12) (see page 15, this study for further discussion of Mansour and Watson). This bias was assumed to have had no effect on the results of the interviews, however, since the researcher was able to

assure each wary interviewee that this research was of a purely exploratory nature.

Automated Management System (AMS)

At the executive level, AMS has been used almost exclusively as a means of transferring electronic mail. This mail must be read since the ASD Command Section sends information to the directorates this way, but the directors are not required to - and 75% choose not to - send mail out via this system. Consequently, the degree of use of the electronic mail system by the executives has set the standard for the rest of their organizations.

The most common explanation for this reluctance to use electronic mail was that there has been a proliferation of messages with courtesy copies being sent without regard for who really needed the information. This has been made possible since the automated system has eliminated the burden and expense of making copies. Consequently, the executives have had to sort through an increasing quantity of unnecessary information. To circumvent this problem, 75% of the subjects required their subordinates to read the mail file and print out copies of the important messages for the executives to read.

Another problem has been that many executives normally write additional comments onto handwritten memoranda and then pass them on to other managers. This cannot be easily accomplished using the electronic mail system as it

currently exists. Additionally, the electronic mail system has presented a problem in the area of security. A secretary, for example, is currently able to send an electronic mail message using an executives name without the executive ever reading it or even knowing about it.

Most of the other available functions of AMS such as word processing, spreadsheet applications, and project management are ignored for several reasons. According to the interviewees, an AMS needs analysis was not performed to their satisfaction. The interviewees stated that computer specialists designed the system based on managerial requirements, but without instilling an understanding of how to define those requirements. According to Larue and Leahy, this is a common shortfall in system design and supports their position that managers have historically had difficulty expressing their information requirements (10) (see page 15, this study for further discussion of Larue and Leahy). This also supports King and Cleland's suggestion that the lack of management involvement in the design process is a contributing factor to the failure of an MIS to perform as well as expected (3) (see page 16, this study for further discussion of King and Cleland). Also, the project management data base was considered to be unreliable by all executives interviewed since it is not kept current. That is, the data has already been superseded and rendered obsolete by the time it is input into the system.

The data is input into the system by the system program offices (SPOs), but the currency problem appeared to lie in the use of the data. The subjects felt that the SPOs did not use AMS to generate or maintain the project management data, therefore, the data is input at some later date as a matter of routine. The accuracy of the data is not strictly monitored, but even when accurate, the data is not current. This leaves the subjects no choice but to obtain additional printed reports with current information.

The interviewees also felt that AMS requires them, as executives, to perform far too many keystrokes to access the system, and they would not use such a system until one is designed which could be accessed quickly and easily. Additionally, neither the centralized word processor nor the spreadsheet available on AMS are used since these functions quickly consume all available computing resources leaving many users with long wait times (in excess of 15 minutes) just to access the system. AMS is avoided also since its users are charged a fee based on their amount of monthly usage. Finally, AMS output must be printed at centralized locations which is, at best, inconvenient for the users.

Micro-computer Usage

Faced with the inadequacies they perceived with the centralized information management concept of AMS, all of the executives interviewed were in the process of implementing desk-top micro-computers at all levels within their

organizations. The use of the micro-computers, although considered in its infancy by the subjects, was perceived to have distinct advantages over AMS. For example: word processing, spreadsheet, and report generating applications could be accomplished without incurring additional usage fees and without waiting for access to the system. This concept was also believed to foster innovation in the development of new and more efficient applications within the organizations.

In addition, the ease of use of the micro-computer concept over the current centralized concept may induce more executives to access the available information, and may also assist them in making decisions involving unstructured problems. For example, information at meetings could be quickly reformatted or redisplayed to identify problems which might otherwise remain hidden. Similarly, additional information not originally prepared for a meeting could be generated on-the-spot as the need is conceived. Many more applications may be envisioned and developed as each organization within ASD learns to fully utilize the capabilities of micro-computers.

However, one problem area surfaced regarding micro-computers, that is their hardware/software incompatibility with AMS. As in Broome's study (2), to work around this problem, the users have been duplicating micro-computer generated information when required for input to AMS (see page 18, this study for further discussion of Broome's study). This

duplication has been time-consuming and has caused data entry errors to increase.

V. Conclusions and Recommendations for Further Study

Overview

This chapter contains the conclusions of this thesis and the recommendations for further study. The purpose of this effort was to determine the adequacy of the information provided to the executive managers at ASD. To accomplish this objective, a sample of executive managers from ASD were interviewed to determine their information needs versus the information which was available to them. The results indicated that staff executives were receiving the information they needed in the form which they preferred, while the line executives were lacking automated data which they needed.

Conclusions

1. The ASD Command Section (Commander, Vice Commander, Chief of Staff) makes a variety of repetitive as well as unstructured decisions. At this level, the repetitive decisions usually appear in the area of personnel management. This being the case, the information the Command Section required to make repetitive decisions is often contained in the personnel management system called Superstars. This system contains career briefs on majors and above as well as high-ranking civilians.

The information the Command Section requires to make unstructured decisions generally includes a consensus of opinions from the Deputy Commanders of ASD as well as the

aggregate background information regarding the situation. The subject indicated that this type of information is not well-suited to computer terminal access (although much of the background information is often compiled using computers). Rather, this type of information is derived through a combination of Staff Summary Sheets, reports, and meetings/briefings.

2. The deputy commanders at ASD indicated that they make mostly unstructured decisions and relatively few repetitive decisions. As with the command section, the repetitive decisions made by the interviewed deputy commanders normally involve personnel management. The deputy commanders do not have the Superstars system available to them, but they indicated a need for such a system.

The subjects interviewed preferred to make unstructured decisions based on the information contained in staff summary sheets, meetings, briefings, and hard copy reports. The executives felt that such decisions should be discussed in an open forum with the documentation in hand for reference. They also stated that the opinions and recommendations of the staff would be difficult to automate. These opinions are often sensitive in nature and would require strict system security to prevent their unauthorized disclosure. The deputy commanders want to have the computing resources available for their organizations to compile the necessary background information, but, as with the Command Section, indicated that information such as the opinions and

recommendations of subordinates cannot be successfully accessed on a computer terminal. The subjects felt that such information and decisions must be discussed and debated in person as well as on paper.

3. The Program Managers stated that they make far more unstructured than repetitive decisions. The necessary information for these subjects includes program status, cost/benefit trade-offs, scheduling, performance analyses, risk analyses, and critical path analyses. While they felt that much of this information can be presented on a computer terminal, the Program Managers prefer hard copy reports and briefings by the technical experts to help explain complex problems. That is, much of the information presented to the Program Managers involves extremely complicated scientific data. The Program Managers may not have the technical expertise, or the time, to analyze the information on a terminal. Therefore, they feel an expert's briefing and explanation of such information, with a printed copy for reference, is necessary. These subjects also believe that this is practical since the Program Managers usually must then brief and report upward the same information.

4. Aside from the Command Section, the executive information systems fail to provide personnel management information. Those directorates that maintain their own personnel management system are accomplishing this by reproducing information which is contained elsewhere such as the master personnel files maintained by the ASD Personnel Office.

The Automated Management System (AMS) also fails to provide current program management information to include cost and scheduling information, and critical path analyses. A particular problem exists in the use of the program management function of AMS. Unless the SPO personnel use AMS to accomplish their work, the data they are responsible for inputting into the system will be out-of-date and ignored by management, as is the current situation. This situation has, according to the interviewees, created a data base which is being periodically updated but seldom accessed, and has apparently wasted the efforts of the SPO personnel involved.

5. Extraneous information provided by the executive information systems at ASD does not cause a problem for any of the executives. The reason, according to the subjects, is that the only information that is accessed is the information that is desired. The system does not automatically generate hard copies of reports or information for individuals who do not request them. The exception being in the electronic mail system which has increased the number of memoranda an executive (or his/her designated subordinate) must review. For those subjects who have a problem with unnecessary information, the source of the information is along traditional lines, that is, increasing volumes of printed material.

Along with the issue of unnecessary information, there is also the issue of extraneous utilities. With the growing

number of micro-computers within ASD, the use of the centralized word processing, spreadsheet, etc. functions on AMS has been greatly reduced. Allowing these apparently unnecessary functions to remain may be wasting valuable computer memory space as well as software maintenance time. Elimination of these functions would permit the addition of new application programs which could be determined by further research. Also, micro-computers have been delivered to many executives who do not require or desire one. Approximately 50% of the subjects stated that they never turned on their desk-top computer. These computing resources could be more efficiently utilized in offices which require them.

6. A translation of the needs analysis into statements of project goals is as follows:

a. The requirement exists for an information system to be developed which would satisfy the executives at ASD.

b. The new system should be based on a network of micro-computers linked to mainframes with common data bases and with the capability to link with contractor data bases.

c. The new system should be designed with the flexibility to adapt to the tremendous variety of information requirements within ASD, for example, the line versus staff differences mentioned in chapter 4.

d. The new system should be easy to operate. A 'mouse' based system would provide the occasional as well as the technical user with a fast and easy access to information.

e. The new system should be designed so that the data base is automatically updated as the technicians complete their work.

f. The use of the new system should be made mandatory throughout ASD.

Recommendations for Further Study

1. Continue the feasibility study as outlined by Ostrofsky (16:29-68) using one of the following means:

a. Conduct additional surveys/interviews at the middle and lower management levels to determine their information requirements versus availability.

b. Combine the results of these surveys to determine a top-down view of ASD's information requirements.

c. Identify and screen candidate systems which may provide solutions to identified problems. For example, further research focusing on the modification of the AMS program management software to improve its use by the SPO personnel to accomplish their work. If the software cannot be modified to serve the needs of the SPOs, focus on the replacement of this software within AMS or at the microcomputer level. Candidate systems should also be evaluated on their abilities to handle the differing requirements of line and staff managers.

2. Conduct the preliminary activities outlined by Ostrofsky (16:71-152).

3. Conduct the detail activities outlined by Ostrofsky (16:153-246).

4. Conduct research into the attitudes of managers at all levels regarding the Information Systems and Technology

Center. This could provide some important feedback to that directorate.

5. Conduct research to determine the extent to which computers can further support unstructured, non-repetitive decisions and how that support can be implemented at ASD.

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VITA

First Lieutenant Kenneth J. Lentini was born on 18 August 1956 in Staten Island, New York. He enlisted in the United States Air Force in October 1977 as an Engineering Assistant. He also attended Saginaw Valley State College in Michigan, from which he received the degree of Bachelor of Business Administration in Management in 1981. He completed Officer Training School and received his commission in June 1984. He completed logistics plans and programs officer training in September 1984. He then served as the Chief, Logistics Plans in the 3800th Air Base Wing, Maxwell AFB, Alabama until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1986.

Permanent address: 1350 Inca Avenue
Spring Hill, Florida 33526

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Block 19. Abstract

The purpose of this study was to determine, using Ostrofsky's design and planning methodology, the adequacy of the information provided to the executive managers at ASD. To accomplish this task, a sample of the executive managers from ASD was interviewed to determine information needs versus the information which was available.

The results indicate that staff executives are receiving the information they need in the form they prefer, while the line executives lack the automated data which they need. Research also revealed that most ASD executives are not satisfied with the Automated Management System for many reasons such as the lack of current data.

The objective of this thesis was not to solve the information requirement problems of the ASD executives. Rather, It was intended to be the first step in a series of research efforts leading to a solution to these problems.

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